

CHAPTER II

RECONNAISSANCE

A. General

Land stations in the tropical Pacific are sparse. Additional observing units have been activated and reports are being received from peace corps stations, but the stations are still widely scattered. Ships which report weather do not usually transit the areas of cyclone formation and, once the cyclone moves into the shipping lanes, it is usually of such intensity that ships will take evasive action to avoid it. Pictures from the ESSA Weather Satellites have proven to be a tremendous aid in the detection of cyclones in the early stages of formation. Interpretation of satellite pictures cannot, however, indicate the center position or the intensity of the cyclone with the accuracy required for issuing warnings and forecasting movement and changes in intensity. Aerial reconnaissance thus remains the only method which can provide surface and upper air data of the accuracy required to issue timely warnings for the safeguarding of life and property. Continuous surveillance of tropical cyclones is of the utmost importance. The accuracy of tropical warnings is directly related to the timeliness, quality, and quantity of data received from reconnaissance aircraft.

Reconnaissance aircraft can remain in the vicinity of a tropical cyclone to report accurate positions and characteristics such as eye shape and orientation, intensity and extent of cloud patterns. By the use of dropsondes or ascent or descent soundings, the aircraft can provide a vertical profile of temperature and dew point, heights of standard levels and sea level pressure.

B. Reconnaissance Responsibility

During the 1968 season two squadrons were assigned the responsibility of tropical cyclone reconnaissance to meet the requirements of the Joint Typhoon Warning Center, Guam. These squadrons were the U. S. Navy Airborne Early Warning Squadron One (VW-1), equipped with the EC 121K aircraft based at Naval Air Station, Agana, Guam and the U. S. Air Force 54th Weather Reconnaissance Squadron (54WRS), equipped with WC-130 aircraft based at Andersen Air Force Base, Guam.

C. Evaluation of Data

Four fixes per day were normally scheduled on typhoons and tropical storms during 1968. Tropical depressions were scheduled for up to four fixes per day depending on location, potential, and feasibility of radar coverage.

In general, low (1500 ft. or below) or intermediate (700 mb) level fixes were made by VW-1 at 0900Z and 1500Z, and intermediate level fixes were made by the 54WRS at 2100Z and 0300Z. High level (500 mb) fixes were made on storms in the vicinity of high terrain. In addition to the fixes, synoptic and investigative flights were flown.

Aerial reconnaissance can be divided, according to data gathered, into three categories: peripheral data, eye data from penetration, and eye data from radar.

Peripheral data is all information reported outside the eye of the storm. It includes a description of sea level pressure, pressure height, a complete description of clouds including types, amounts and heights of tops and bases, flight altitude winds, temperature, dew point, and surface winds. Peripheral data obtained while circumnavigating the storm between fixes often includes dropsonde soundings. This same type of data is also provided on all synoptic and investigative flights.

Eye data from radar provides a description of the radar eye and its location, including a description of spiral bands and height and width of the wall cloud. Also included is the aircraft position at the time the radar observation is taken. Due consideration is given to the distance of the aircraft from the storm center in evaluating the accuracy of the fix since attenuation can distort the image when the distance is considerable. Also, allowance is made for the possibility that the radar or cloud eye may not coincide with the wind eye.

On all eye messages figures are given in nautical miles indicating the accuracy of the location of the center and the navigational accuracy of the fix. The type of navigation used by the aircraft is indicated and figures are given indicating the confidence attached to each of the parameters used to locate the eye, i.e. temperature, pressure, wind, etc. All of this information is used by JTWC in evaluating the fix accuracy.

During 1968, daylight penetrations were made on all but a few of the most severe storms. When possible EC 121K aircraft also penetrated the storms for night fixes. Many of the night penetrations were made at 1500 ft. or below, especially when the storms were too weak for radar coverage. Location of the circulation center with the aid of the aircraft landing lights was not uncommon when the center could not be determined by other means.

Aircraft Reconnaissance Data

(Number of Fixes and Investigations)

<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
350	496	465	772	666	674	845	807*

* 167 preliminary or intermediate (No credit)

fixes not included.

In addition there were 184 synoptic tracts flown in 1968.

The information from the aircraft was continually checked for consistency and accuracy. Where possible, JTWC graphs and other aids were used to check and compare data with previous reports. Verification was immediately requested from the observing aircraft on any apparent discrepancy in the data.

D. Communications

The primary means of communication between ground stations and reconnaissance aircraft was voice single sideband. Commencing with the 1968 season, Andersen Airways (AIE2) was the primary air to ground station for 54WRS and VW-1. The JTWC "Enjoyment" circuit was not used during the 1968 season. The secondary air to ground stations were Clark AFB, Republic of the Philippines; Fuchu Airways, Japan; and Kadena Airways, Okinawa. When the secondary stations were used, the primary method of passing eye data between the aircraft and the Swan monitor was via the Joint Overseas Switch (JOSS). Eye data messages received by Swan monitor by direct phone patch with the aircraft were received simultaneously by JTWC via hotline connection with

Swan monitor. In addition to the hotline patch, a copy of the eye message was transmitted to JTWC from Andersen Airways by local teletype circuit SDE 9.

The routine use of the hotline between Swan monitor and JTWC led to a significant reduction in communications delay times. Fixes continued to be levied only 2 hours prior to warning time. In only 6 cases were the eye messages received after warning time. The cases of excessive delays generally occurred when the aircraft had to communicate through one of the secondary stations. The greatest delays occurred on fixes made in the South China Sea.

The average delay time from the aircraft to JTWC by phone patch was 23 minutes. This includes the delay in the aircraft by the meteorologist, and the time for JTWC to copy the complete eye data message. The maximum delay by phone patch was 1 hour 26 minutes and the minimum delay just a few minutes. Receipt of the eye data message in less than 10 minutes was not uncommon when communications were good. Besides the reduction in delay time, direct communication with the aircraft has the advantage of allowing immediate clarification of doubtful data. Relay of the latest meteorological information, including satellite data, directly to the flight meteorologist on the investigative flights often pinpointed a suspicious area more exactly and thus allowed the aircraft to spend more time in productive reconnaissance.

The following statistics show the delays between time of fix and time of first receipt at JTWC. The methods used in getting the fix to JTWC are shown for comparison.

DELAY IN RECEIPT OF RECONNAISSANCE FIX DATA FOR 1968				
<u>METHOD</u>	<u>NUMBER OF CASES</u>	<u>MAX DELAY TIME</u>	<u>MIN DELAY TIME</u>	<u>AVG DELAY TIME</u>
PHONE PATCH	795	1 HR 26 MIN	0 HR 01 MIN	0 HR 23 MIN
SDE 9	123	1 HR 35 MIN	0 HR 04 MIN	0 HR 36 MIN
OTHER	16	6 HR 25 MIN	0 HR 23 MIN	1 HR 26 MIN

Table 2-1 contains some statistics on communications delays encountered in 1968 along with figures from previous years for comparison.

COMPARISON OF DELAY TIMES WITH PREVIOUS YEARS

	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
MAX DELAY TIME	60 HR 45 MIN	60 HR 09 MIN	4 HR 33 MIN	11 HR 20 MIN	6 HR 25 MIN
AVG DELAY TIME	1 HR 14 MIN	1 HR 05 MIN	1 HR 02 MIN	0 HR 43 MIN	0 HR 25 MIN
MIN DELAY TIME	8 MIN	9 MIN	FEW MINUTES	FEW MINUTES	FEW MINUTES
PERCENT OF EYE MESSAGES DELAYED MORE THAN 1 HOUR	59%	39%	38%	16%	4%
NUMBER OF FIXES RECEIVED AFTER WARNING TIME	46	34	30	23*	6*
PERCENT OF FIXES RECEIVED AFTER WARNING TIME	8.0%	5.7%	5.4%	3.1%	0.7%

*1967 and 1968 fixes scheduled 2 hours prior to warning time vice 3 hours prior to warning time during previous years.

TABLE 2-1

E. SUMMARY OF RECONNAISSANCE REPORT

In an effort to make the crediting of the reconnaissance effort more objective and meaningful, a system was devised in 1965 to credit fixes and investigations. The same system with minor modifications has been in use since that time. The problem of why a fix was early, late, or missed entirely, although of interest and concern to JTWC, belongs to the Tropical Cyclone Reconnaissance Coordinator (TCRC). The time of warning and the inherent delay from scheduled fix times were the determining factors used in the crediting scheme. Obviously, it would be desirable to have the fix made as near warning time as possible. Prior to 1967 it was necessary to schedule the fixes 3 hours before warning time to allow for normal communications delays. More rapid communications in 1967 and 1968 has permitted scheduling of fixes 2 hours prior to warning time. This usually allowed ample time to digest the information after receipt of the data. The crediting system is described in Table 2-2.

DEFINITIONS OF FIX CREDITS

<u>CLASS</u>	<u>DEFINITION</u>	<u>FIX CRITERIA</u>
1	Full Credit	From 1 hour before 1/2 hour after levied time.
2	Full Credit	Aircraft in area requested within 1 hour before to 1/2 hour after levied time but unable to locate a center.
3	Early/Late	Center located to 1 1/2 hours before or 1/2 to 2 hours after levied time.
4	Very Early/Very Late	Greater than 1 1/2 hours before or more than 2 hours after levied time.
5	Attempted but missed fix	Recon provided some useful peripheral data but no fix was made. Reasons may include clearance problems, mechanical trouble, low fuel, etc.
6	Missed fix	Missed fixes not falling into any category above.
7	Full Credit	Fix made on investigative flight or synoptic track.
8	Full Credit	Investigative flight, no fix made.
9	No Credit	Preliminary or intermediate fix made between scheduled fixes.

TABLE 2-2

This system requires subjective evaluation of some fixes. For example, an aircraft could be in the area assigned on time, but unexpected storm acceleration could make the cyclone too distant to be reached within normal

time limits. In this case, full credit is given with no penalty for a late fix.

EVALUATION OF TIMELINESS OF RECONNAISSANCE FOR 1968

<u>CLASS</u>	<u>NUMBER</u>
1	699
2	20
3	22
4	7
5	1
6	5
7	34
8	24
9	167